Increasing the Functionality of Military Coatings Using Nano-dimensioned Materials

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The coating system presently used on military aircraft is constrained in function (e.g., static color, low glint) and limited to the use of toxic, chromate-based compounds for the mitigation of corrosion. This poster summarizes a Multi-Disciplinary Research Initiative (MURI) that has been tasked by DoD, AFOSR, and AFRL to establish the foundation for a military aerospace coating with expanded functionality and environmental compliance. By implementing advances in molecular and nano-engineered materials, an academic team has identified the enabling science for a multi-functional coating system with the ability to provide:

(1) Corrosion protection using environmentally compliant materials
(2) Sensing of corrosion and mechanical damage of the aircraft skin
(3) Mitigating responses to sensed chemical and physical damage
(4) Color-on-demand
(5) Optimal adhesion using environmentally compliant materials
(6) Fatigue resistance and mechanical integrity of the fuselage
(7) Self-cleaning and water rejection character

The enhanced functionality of this advanced coating system is achieved through the research and development of now tangible technologies. These components include:

(1) A field-replaceable, nano-engineered aluminum alloy cladding,
(2) New approaches for the identification, encapsulation, and intelligent delivery of environmentally compliant corrosion inhibitors for paint,
(3) Colloidal crystals, and photonic antenna for sensing and color-change-on-demand,
(4) Optimization of organic coating adhesion to the aluminum alloy substrate through the use of an environmentally compatible surface treatment.
(5) Development of self-assembled biomimetic surfaces for superhydrophobicity

The research from this MURI has resulted in tangible coatings and coating additives with very promising and realizable benefit to Air Force assets. This research needs to be converted from research into development. We are currently seeking partners and funding mechanisms to achieve this goal.